TERRELL

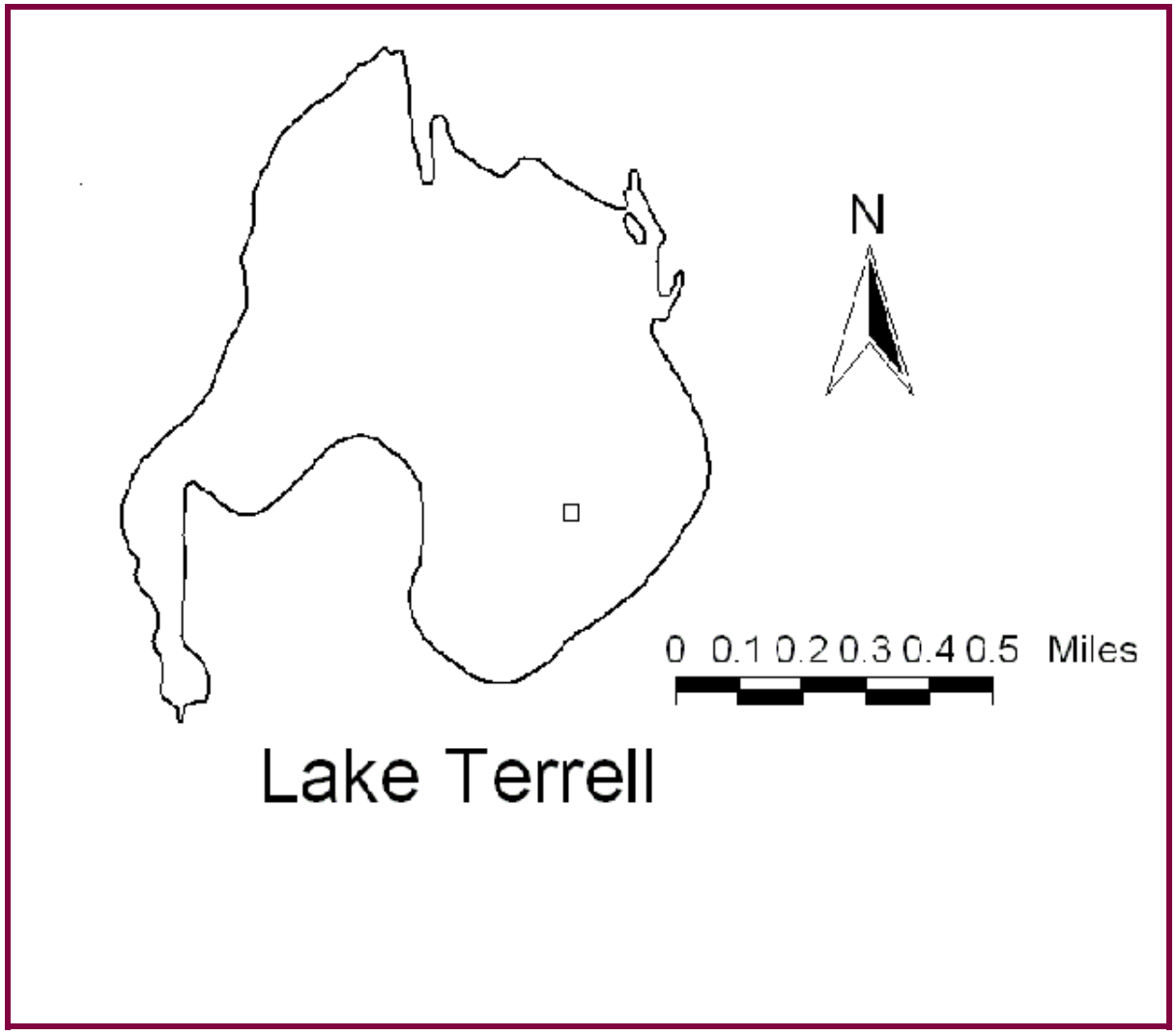
WHATCOM County

Lake ID: *TERWH1*

Ecoregion: 2

Lake Terrell is a shallow lake surrounded mostly by a wildlife refuge. There is also access for livestock along the west shore. Some of the habitat has been altered to favor Canada goose reproduction and to attrack other waterfowl. It is located five miles west of the city of Ferndale, north of Bellingham. It is fed by an intermittent, unnamed tributary and drains via Terrell Creek to Birch Bay.

Area (acres)	*Maximum Depth (ft)*	*Mean Depth (ft)*	*Drainage (sq mi)*	
435	10	7	3	
Volume (ac-ft)	***Shoreline (miles)***	***Altitude (ft abv msl)***	***Latitude***	***Longitude***
2950	3.84	212	48 52 10.	122 41 19.



Station Information

TERWH1

Primary Station	Station # 1	latitude: 48 51 44.0	longitude: 122 41 02.8

Description: Located approximately 1500 feet northeast of boat launch.

Trophic State Assessment for 1999

TERRELL

Analyst: Sarah O'Neal

TSI_Secchi: [a]	53	WB	
TSI_Phos:	55		
TSI_Chl:	56		
Narrative TSI: [b]	E		

Terrell Lake is a mid-sized, extremely shallow, productive lake surrounded by a wildlife refuge. Land uses in the watershed were primarily agriculture, with some natural land provided for wildlife. Cattle grazed on agricultural land, and used the lake for watering since there was no fencing to limit access. The lake may be naturally eutrophic. Nutrient levels were not exceptionally high and the lake did not stratify, so there was no evident internal nutrient loading or hypolimnetic anoxia. Dense vegetation surrounded the shoreline, which lacked significant human influence. Cattle grazing and alteration of habitat to favor Canada geese and other waterfowl likely impacted the lake, however. Plants and algae grew densely in the lake. There was an extremely diverse macrophyte community, with no dominant species. The invasive wetland plant, purple loosestrife (Lythrum salicaria), grew around the lake, but not in excess. Frequent floating mats of algae and blue green scum reduced water clarity. Questionnaire respondents indicated a desire for less algae.

The lake was used primarily for hunting and fishing. Questionnaire respondents indicated a desire for good warmwater fishing and public access. The lack of primary contact uses made water clarity and nutrient loading less important as in other lakes. A secondary use of the lake was livestock watering. Since the lake was not used for primary contact recreation, allowing livestock a small watering access to the lake may not present a threat to the beneficial uses. The lake and its surroundings provided an abundance of natural habitat for fish and wildlife. WDFW planted the lake annually with channel catfish. Resident cutthroat trout were also occasionally planted in the lake. No anadromous fish used the lake due to a water-regulating dam at the outlet. According to WDFW officials, it is highly probable that sea-run cutthroat trout formerly used the lake to access its intermittent tributaries for spawning. It is unknown whether or not coho salmon may have used the lake in the past. Warmwater fish species included largemouth bass, brown bullhead, perch, channel catfish and bluegill. The small average zooplankton size indicated a possible overabundance of prey species relative to predators. Fishing was open year round on the lake, though it received only about 50 anglers on opening day in 1999.

Beneficial uses appeared to be largely supported. Since the lake was not generally used for primary contact recreation, dense plants and algae did not appear to hinder

uses. Consequently, we recommend a total phosphorus criterion of 41.0 ug/L (mean 34.5 ug/L plus standard deviation of 6.5 ug/L).

Mean Secchi = 1.6m WB; Mean TP = 34.5 ug/L; Mean Chl = 13.1 ug/L

[a] TSI Qualifiers: B or W-Secchi Disk hit bottow or entered weeds; J-Estimate; N-Fewer than the required number of samples

[b] E=eutrophic, ME=mesoeutrophic, M=mesotrophic, OM=oligomesotrophic, O=oligotrophic

Chemistry Data

TERRELL

Date	Time	Strata	Tot P (ug/L	Tot N (mg/L)	TN:TP	Chloro-phyll (ug/L)	Fecal Col. Bacteria (#/100mL)	Hardness (mg/L)	Calcium (ug/L)	Turbidity (NTU)
Station 1										
6/7/1999		E	28.9	.933	32	16.8		32.4	6820	
7/13/1999	1209	E	32.2	.828	26	12.6				2.3
8/12/1999		E	45.8	.878	19	12.4				
9/9/1999	1100	E	34.1	.732	21	10.7				3

Strata: L=lake surface, E=epilimnion, H=hypolimnion; Qualifier: J=Estimate, U=Less than, G=Greater than.

Watershed Survey

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Survey Date: 9/9/1999

Land Uses (1 = Primary, 2 = Secondary, etc.)

1	**Agriculture(commercial, not hobby)**		**Residential**
	Commercial, Industrial	2	**Park, forest or natural**
	Major transportation		

Impervious surfaces (Roads and parking area): No Curbs

Observations (check mark denotes presence)

BMP's ☐

Cattle in the water all along the west shoreline.

Odors ☐

None noted

Cattle ☑ **Ducks** ☑ **Geese** ☑

Cattle along the west shore. Many ducks and geese throughout the lake.

Fertilizers and weed killers appear to be used in residential or agriculture area ☐

None

Buffer zones around streams and wetlands ☐

Irrigation ☐

Habitat Survey Summary Report

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Data are averages of ***10*** **Stations Surveyed** **Date of Visit:** 9/9/1999

Vegetation Type (Avg. only of sites w/ vegetation present; 1=coniferous, 3=deciduous)

Canopy Layer Avg:	2.9	**Number of stations with canopy:**	8
Understory Avg:	2.9	**Number of stations with understory:**	9

Percent Areal Coverage (0 = absent, 1 = <10%, 2 = 10-40%, 3 = 40-75%, 4 = >75%)

Canopy Layer:	**trees > 0.3 m DBH**	1.8
	trees< 0.3 m DBH	1.3
Understory:	**woody shrubs _saplings**	2.0
	tall herbs, forbs _grasses	0.3
Ground Cover:	**woody shrubs _seedlings**	0.7
	herbs, forbs, _grasses	1.1
	standing water or inundated veg	0.4
	barren or buildings	0.0
Substrate Type (within shoreline plot):	**bedrock**	0.0
	boulders	0.3
	cobble/gravel	0.3
	loose sand	0.0
	other fine soil/sediment	0.1
	vegetated	3.4
	other	0.0
Bank Features:	**angle (O:<30; 1: 30-75; 2:nr vertical)**	0.4
	vertical dist (M from wtrln to high wt):	0.0
	horiz. dist. (M from wtrln to high wt):	0.1

Human Influence (0 = absent, 1 = adjacent to or behind plot, 2 = present within plot)

buildings	0.0
commercial	0.0
park facilities	0.0
docks/boats	0.2
walls, dikes, or revetments	0.2
litter, trash dump, or landfill	0.0
roads or railroad	0.3
row crops	0.0
pasture or hayfield	0.4
orchard	0.0
lawn	0.0

other	0.2

Physical Habitat Characteristics

station depth (m; at 10 m from shore)	1.1

Bottom Substrate (0 = absent, 1 = <10%, 2 = 10-40%, 3 = 40-75%, 4 = >75%)

bedrock	0.0
boulders	0.0
cobble	0.1
gravel	0.0
sand	0.0
silt	3.6
woody debris	0.1

Macrophyte Areal Coverage (0 = absent, 1 = <10%, 2 = 10-40%, 3 = 40-75%, 4 = >75%)

submergent	1.8
emergent	1.9
floating	2.0
total weed cover	3.8
Do macrophytes extend lakeward (-1 = yes, 0 = no)	-1.0

Fish Cover (0 = absent, 1 = Present but sparse, 2 = moderate to heavy)

aquatic weeds	1.9
snags	0.3
brush or woody debris	0.8
inundated live trees	0.1
overhanging vegetation	1.3
rock ledges or sharp dropoffs	0.2
boulders	0.1
human structures	0.2

Data are averages of ***10*** **Stations Surveyed** **Date of Visit:** 9/14/1999

Vegetation Type (Avg. only of sites w/ vegetation present; 1=coniferous, 3=deciduous)

Canopy Layer Avg:	2.3	**Number of stations with canopy:**	9
Understory Avg:	2.7	**Number of stations with understory:**	10

Percent Areal Coverage (0 = absent, 1 = <10%, 2 = 10-40%, 3 = 40-75%, 4 = >75%)

Canopy Layer:	**trees > 0.3 m DBH**	2.0
	trees< 0.3 m DBH	2.3
Understory:	**woody shrubs saplings**	2.4

	tall herbs, forbs grasses	0.9
Ground Cover:	**woody shrubs seedlings**	2.1
	herbs, forbs, grasses	2.5
	standing water or inundated veg	1.5
	barren or buildings	0.7
Substrate Type (within shoreline plot):	**bedrock**	0.0
	boulders	0.0
	cobble/gravel	0.0
	loose sand	0.0
	other fine soil/sediment	0.7
	vegetated	3.8
	other	0.0
Bank Features:	**angle (O:<30; 1: 30-75; 2:nr vertical)**	0.7
	vertical dist (M from wtrln to high wt):	0.1
	horiz. dist. (M from wtrln to high wt):	0.0

Human Influence (0 = absent, 1 = adjacent to or behind plot, 2 = present within plot)

buildings	0.0
commercial	0.0
park facilities	0.1
docks/boats	0.1
walls, dikes, or revetments	0.0
litter, trash dump, or landfill	0.0
roads or railroad	0.0
row crops	0.0
pasture or hayfield	0.1
orchard	0.0
lawn	0.1
other	0.0

Physical Habitat Characteristics

station depth (m; at 10 m from shore)	1.1

Bottom Substrate (0 = absent, 1 = <10%, 2 = 10-40%, 3 = 40-75%, 4 = >75%)

bedrock	0.0
boulders	0.0
cobble	0.0
gravel	0.2
sand	0.2
silt	3.8
woody debris	0.4

Macrophyte Areal Coverage (0 = absent, 1 = <10%, 2 = 10-40%, 3 = 40-75%, 4 = >75%)

submergent	2.3

emergent	2.1
floating	2.3
total weed cover	3.8
Do macrophytes extend lakeward (-1 = yes, 0 = no)	-1.0

Fish Cover (0 = absent, 1 = Present but sparse, 2 = moderate to heavy)

aquatic weeds	2.0
snags	0.1
brush or woody debris	0.1
inundated live trees	0.0
overhanging vegetation	0.7
rock ledges or sharp dropoffs	0.0
boulders	0.0
human structures	0.0

Questionnaire

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Results compiled from 6 **Surveys.** **Average time (years) respondents spent on lake:** 8.40

Did the following add (+1), detract (-1), or have no effect (0) on your enjoyment of the lake today?

Types of WaterCraft:	0.0	View:	0.5	Distance to Lake:	0.5
Public Access:	0.3	Swim Beach:	-0.4	Canada Geese:	-0.2
Water Clarity:	0.4	Water Qual. for Swim:	-0.3		
Fishing Quality:	0.2	Aquatic Plants:	0.3		

On a scale of 1 (poor) to 5 (excellent), how would you rate water quality today? **3.0**

Which would you rather have, 1 or 2?

1) Better fishing and more natural habitat, or 2) clearer water?	1.2
1) Better fishing and more natural habitat, or 2) fewer aquatic plants?	1.0
1) Clearer water, or 2) fewer aquatic plants?	1.8

How important is each of the following characteristics to you (1 = very undesirable, 5= very desirable):

Restricted Watercraft:	3.7	Good Warmwtr Fishing:	4.8	Natural Scenery:	3.8
Plant Growth:	3.3	Good Swimming:	2.5	Public Beach:	2.3
Natural Shoreline:	3.8	Less Algae:	4.7	Canada Geese:	2.8
No Odors:	3.7	Public Access:	4.0		
Good Coldwtr Fishing:	2.8	Clear Water:	3.2		

Tabulated Results

Survey ID	Date	Residency	Rent or Own	Primary Activity*	Water Clarity: Purchase Factor?	Water Clarity: Has it Changed?	Water Clarity: When?
107	9/8/1999	Visitor		2	☐	Unknown	
108	9/9/1999	Visitor		2	☐	No	
	Quality fishing management style instead of quality production of small fish.						
151	6/8/1999	Visitor		2	☐	No	

155	6/7/1999	Visitor	10	☐	Unknown
161	6/7/1999	Visitor	2	☐	No
	No swimming or wakes. Manage lake for fishing only.				
208	7/13/1999	Visitor	7	☐	Unknown

* 1=canoe/kayak, 2=fish, 3=pers. wtrcrft, 4=mtrboat, 5=sail, 6=swim/wade, 7=watch wldlf, 8=ski, 9=windsurf, 10=relaxing

Zooplankton Report

TERWH1

Date 6/7/1999 Station: 1 Sample ID 65

Hundreds of rotiers.

Number of organisms measured: #Delet

Group	Percent	Group	Percent
Cladocera	#Deleted	Small < 1mm	#Deleted
Copepod	#Deleted	Large >= 1mm	#Deleted
Other	#Deleted	Ratio of large to Smal	#Num!
		Average size (mm):	0.32

Date 8/12/1999 Station: 1 Sample ID 53

About 1/2 mL measured. Site and length of tow not labelled.

Number of organisms measured: #Delet

Group	Percent	Group	Percent
Cladocera	#Deleted	Small < 1mm	#Deleted
Copepod	#Deleted	Large >= 1mm	#Deleted
Other	#Deleted	Ratio of large to Smal	#Num!
		Average size (mm):	0.26

Aquatic Plant Data

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Sampler: Parsons, O'Neal

Survey Date: 9/14/1999

Max depth of growth (M): throughout

Comments Sunny, calm. Floating mats of algae and blue green scum. Substrate fairly firm - solid layer under muck. Ducks and geese present. Very productive. Only saw a little Lythrum salicaria. Popular fishing area. Secchi depth >2m, past bottom of lake. Did habitat survey.

SPECIES LIST

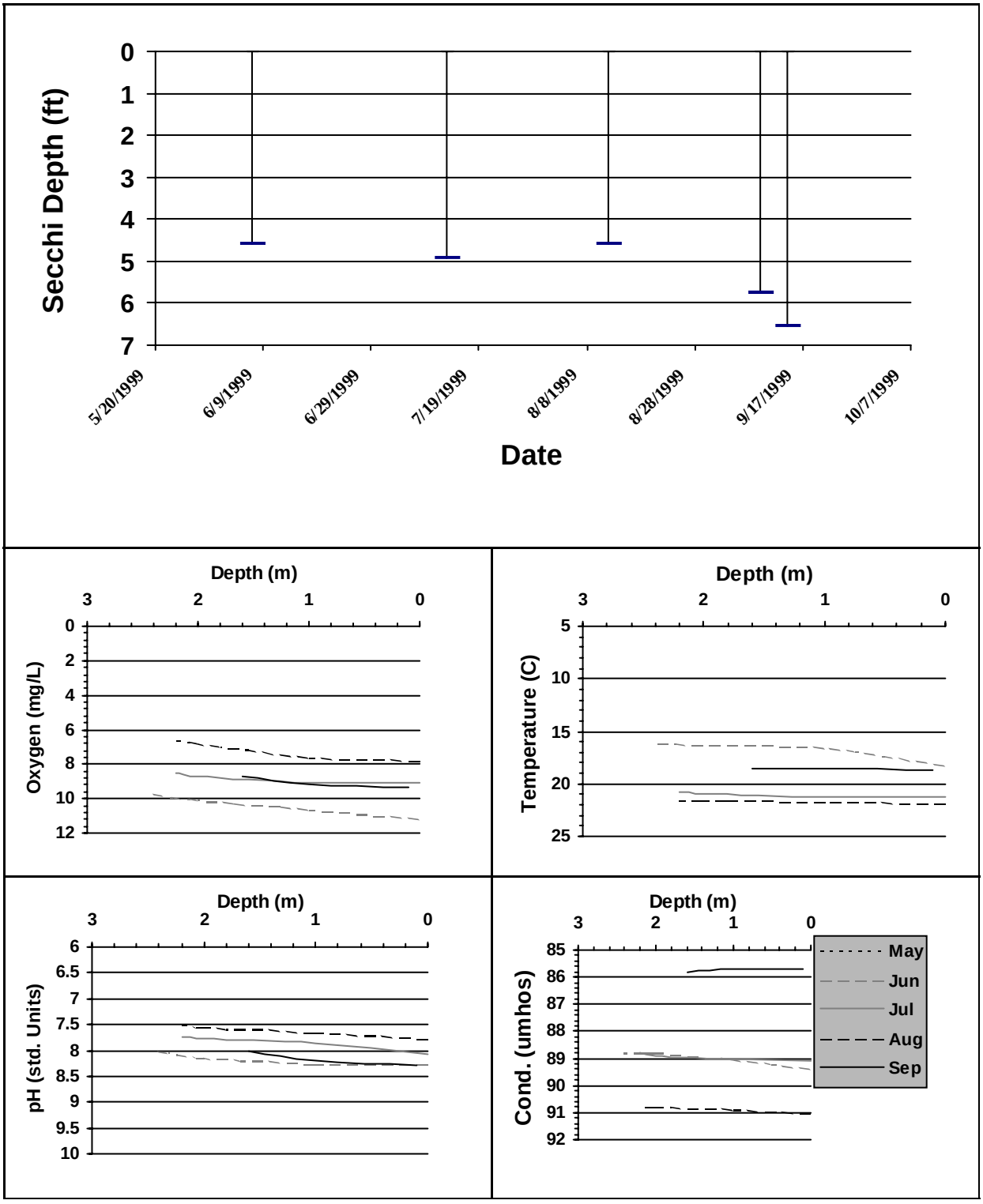
Scientific Name	Common Name	Dist [a]	Comments
Brasenia schreberi	watershield	2	
Ceratophyllum demersum	Coontail; hornwort	3	
Chara sp.	muskwort	1	
Dulichium arundinaceum	Dulichium	1	
Eleocharis sp.	spike-rush	2	in shallows, emergent
Elodea canadensis	common elodea	2	
Lemna minor	duckweed	1	
Lythrum salicaria	purple loosestrife	1	on east shore
Myriophyllum sp.	water-milfoil	1	sibericum or verticillatum
Myriophyllum hippuroides	western watermilfoil	1	
Najas flexilis	common naiad	1	

Nitella sp.	stonewort	2	
Nuphar polysepala	spatter-dock, yellow water-lily	3	
Polygonum amphibium	water smartweed	2	
Polygonum hydropiperoides	common smartweed	1	
Potamogeton amplifolius	large-leaf pondweed	2	
Potamogeton epihydrus	ribbonleaf pondweed	1	
Potamogeton natans	floating leaf pondweed	1	
Potentilla palustris	purple (marsh) cinquefoil	1	
Potamogeton praelongus	whitestem pondweed	2	
Potamogeton sp (thin leaved)	thin leaved pondweed	2	
Potamogeton zosteriformis	eel-grass pondweed	1	
Scirpus sp.	bulrush	2	bulrush
Sparganium sp.	bur-reed	2	
Tolypella intricata	macro algae	2	
Typha latifolia	common cat-tail	3	
Utricularia vulgaris	common bladderwort	2	
Vallisneria americana	water celery	3	
Zizania aquatica	wild rice	2	

[a] 0 - value not recorded (plant may not be submersed)
1 - few plants in only 1 or a few locations
2 - few plants, but with a wide patchy distribution
3 - plants in large patches, codominant with other plants
4 - plants in nearly monospecific patches, dominant
5 - thick growth covering substrate to exclusion of other species

Secchi Depth and Profile Graphics

Station: 1 TERWH1



Secchi Data and Field Observations

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Date	Time	Temp-erature (F)	Secchi (ft)	Color (1-greens, 11-browns	Bright-ness (pct)	Wind (1-none, 5-gusty)	Rainfall (0-none, 5-heavy)	Aesthetics (1-bad, 5-good)	Swimming (1-poor, 5-good)	Geese (#)	Waterfowl (besides geese #)	Boats-Fishing (#)	Boats-Skiing (#)
Station 1													
6/7/1999			4.59	6	0			5	3	200	0	3	0
	Sampler: SMITH			Remarks: Many swallows flying above water.									
7/13/1999			4.92 W	7	0	3		5	1	46		3	0
	Sampler: SMITH			Remarks: Geese are raised by wildlife refuge so actual population may not reflect a natural state.									
8/12/1999			4.59	9	80			5	1	2	0	1	0
	Sampler: SMITH			Remarks: Plants starting to senesce.									
9/9/1999			5.74	8	100			5	2	130	35	2	0
	Sampler: SMITH			Remarks: Olive-green algal bloom. Livestock all along west shoreline in the lake. No fencing to limit access. Milfoil spotted on east shore. Huge algal mats in water. Large Bryozoans.									
9/14/1999			6.56 B										
	Sampler: Parsons			Remarks:									